This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

---

1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{13225}{25}}$$

The solution is Whole, which is option E.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 115.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 - 5i)(3 - 4i)$$

The solution is $1 - 43i$, which is option B.

A. $a \in [1, 5]$ and $b \in [41, 51]$

$1 + 43i$, which corresponds to adding a minus sign in both terms.

B. $a \in [1, 5]$ and $b \in [-43, -38]$

* $1 - 43i$, which is the correct option.

C. $a \in [40, 44]$ and $b \in [12, 17]$

$41 + 13i$, which corresponds to adding a minus sign in the second term.

D. $a \in [40, 44]$ and $b \in [-15, -7]$

$41 - 13i$, which corresponds to adding a minus sign in the first term.

E. $a \in [21, 24]$ and $b \in [20, 23]$

$21 + 20i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

3. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 16^2 + 7 \div 6 * 5 \div 2$$

The solution is -241.083, which is option D.

A. $[270, 274.4]$

270.917, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[267.4, 269.4]$

268.117, which corresponds to two Order of Operations errors.

C. $[-245.1, -241.9]$

-243.883, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-242.5, -240.2]$

* -241.083, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{225}{196}} + 4i^2$$

The solution is Rational, which is option C.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Rational

* This is the correct option!

D. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 - 2i)(3 + 4i)$$

The solution is $-7 - 26i$, which is option E.

A. $a \in [-18, -11]$ and $b \in [-11, -5]$

$-15 - 8i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [-32, -21]$ and $b \in [13, 19]$

$-23 + 14i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-9, -5]$ and $b \in [24, 31]$

$-7 + 26i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-32, -21]$ and $b \in [-20, -11]$

$-23 - 14i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-9, -5]$ and $b \in [-29, -19]$

* $-7 - 26i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

6. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 6 \div 9 * 5 - (20 * 3)$$

The solution is -59.333, which is option C.

A. $[-58.3, -57.8]$

-58.000, which corresponds to not distributing a negative correctly.

B. $[-56.4, -53.1]$

-56.133, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-61.6, -58.2]$

* -59.333, which is the correct option.

D. $[61.6, 64.1]$

63.867, which corresponds to not distributing addition and subtraction correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 + 44i}{-2 - 3i}$$

The solution is $-18.46 + 5.69i$, which is option C.

A. $a \in [-27.5, -25.5]$ and $b \in [-15, -13.5]$

$-27.00 - 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [0.5, 3]$ and $b \in [-19.5, -18.5]$

$1.85 - 19.23i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-20.5, -17.5]$ and $b \in [4.5, 7.5]$

* $-18.46 + 5.69i$, which is the correct option.

D. $a \in [-240.5, -239]$ and $b \in [4.5, 7.5]$

$-240.00 + 5.69i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-20.5, -17.5]$ and $b \in [72.5, 74.5]$

$-18.46 + 74.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{400}{49}} + \sqrt{156}i$$

The solution is Nonreal Complex, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Nonreal Complex

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-36 + 77i}{-1 + 8i}$$

The solution is $10.03 + 3.25i$, which is option E.

A. $a \in [650.5, 653]$ and $b \in [2, 5]$

$652.00 + 3.25i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [9.5, 12]$ and $b \in [210, 211.5]$

$10.03 + 211.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-10, -7.5]$ and $b \in [-7, -5.5]$

$-8.92 - 5.62i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [34.5, 37.5]$ and $b \in [9, 10]$

$36.00 + 9.62i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [9.5, 12]$ and $b \in [2, 5]$

* $10.03 + 3.25i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{10}{0}}$$

The solution is Not a Real number, which is option B.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Not a Real number

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{10}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
